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ORIGINAL RESEARCH

Infant Mortality in Mother and Baby Homes in 20th Century Ireland

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Abstract

During the first half of the 20th century, infant mortality in the general population fell by more than 50% in higher income countries. Despite accounting for a disproportionately high share of deaths in these countries during this period, few quantitative studies have examined the experiences of infants who were born or raised in an institutional context. In this paper, we quantify mortality rates in Mother and Baby Homes in Ireland, institutions that were aimed primarily at unmarried mothers and their infants. Using information on over 40,000 infants born in the 6 largest of these insitutions in Ireland, we assess how this risk of mortality changed over the course of the 20th century relative to the general population, and assess variation in death rates by observed characteristics. The mortality penalty for these institutions was greatly elevated, reaching four times the national mortality rate in the 1930s and 1940s. By comparing the outcomes of infants from the Mother and Baby Homes with the rest of the population using large-scale quantitative data, this study documents the scale of the disadvantage faced by marginalised communities born outside public hospital systems, and highlights the potential role of nutrition-related causes in these disparities.

Keywords Institutional Mortality · 20th Century Demographic History · Infant Mortality

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Introduction

A substantial portion of the gains in life expectancy in higher income countries over the course of the last century has been due to reductions in early-life mortality, specifically improvements in death rates before the age of 5. Reductions in infant and child mortality from 1900 to 1940 accounted for almost 80% of the increase in life expectancy at birth in the US during this period (Cutler & Meara, 2003). Unsurprisingly, given the central role these events played in the demographic transition, a large literature has documented determinants of early age mortality during this time, although it has largely focused on the general population at the national or local levels. Findings from this literature emphasise the role of clean water and sanitation, public health governance (Hoehn-Velasco, 2018), and nutrition (Komisarow, 2017). For instance, city infrastructure projects on chlorination, filtration, and sewage have been credited for a third of the declines in infant mortality in the late 19th and early part of the 20th century (Alsan & Goldin, 2019; Cutler & Miller, 2005). While variation in environments and policies within the US has provided important identification opportunities for these papers, similar findings of an urban mortality penalty have been documented in other higher income nations during this time period, such as the UK (Williams & Galley, 1995; Woods, 2003), Denmark (Torres, 2021), and Ireland (Delaney et al., 2011).

As well as playing a major role in the demographic transition, understanding heterogeneity in infant mortality and its determinants is also important because of the implications for addressing racial and socioeconomic disparities in mortality (Collins & Thomasson, 2004), and the long-run consequences associated with improvements in early life conditions (Torche, 2019). This literature is also important because identifying the most effective interventions for historically high rates of mortality can inform the design of public health programs where infant mortality currently remains high (Bhatia et al., 2019).

One area where the quantitative literature has not yet been able to provide much insight is on the population of women who gave birth in (or were subsequently transferred to) institutions outside the public health care system, and their infants. In the early 20th century in higher income countries, natality outside public hospitals comprised mainly home births and births and/or postnatal care in private institutions, such as charitable or religious-run Homes. In some contexts, women may have been prevented from, or otherwise been unable, unwilling, or unwelcome to give birth or receive postnatal care for them and their infants in public or government hospitals or medical centers. As a result, members of these populations were both more likely to receive postnatal care for them and their infants outside of the public hospital system, and at greater risk of adverse outcomes. Members of this cohort often also comprised socially marginalised and under-served populations. Therefore, analysis of records from these institutions provides an important historical demography contribution to the literature on how discrimination exacerbates disparities in the health of pregnant women and adverse birth outcomes.

In the historical context we consider, one major basis on which women were discriminated against, particularly during pregnancy, was marital status. This discrimination is evident in the terms used to describe children born to single parents, the

social stigma and exclusionary practices associated with births outside marriage, and the increased risk of adverse maternal and infant outcomes for those in this population, which has been documented in a variety of contexts across the early part of the 20th century. In Ireland during this time period, Catholic teaching had a significant influence on all aspects of life, including social norms (especially as they related to gender and sexuality) and the organization of healthcare provision. One consequence of this was the elevation of one definition of a family unit (narrowly characterised as constituting a married woman and man with children) as an ideal, and the denigration of other family types that did not meet this definition (Earner-Byrne, 2007). Unmarried mothers and their children may not have been viewed as a family unit, and there were few efforts to keep mother and infant together (Earner-Byrne, 2008). At least partly as a result of this stigma, specific institutions were formed to maintain a separation between peripartum women who were married and women who were unmarried, and their children.

In Ireland, a relatively large number of births to unmarried women took place in institutions known as Mother and Baby Homes, around 75,000 births during the period 1920–1980 (Commission of Investigation into Mother and Baby Homes, 2021). Until the 1970s, the number of births outside marriage varied between 1,000 and 3,000 per year, which comprised 2–6% of total births in Ireland. For example, there were 58,849 total births in Ireland in 1922, the first year of independence from the United Kingdom, with 1,520 births outside marriage. During the subsequent years after independence, the Homes accounted for 20-30% of births outside marriage in the 1930s and 1940s, 30-40% in the 1950s, rising to 50% in the 1960s before declining exponentially thereafter. While Mother and Baby Homes or similar institutions were present in other countries, in Ireland the proportion of women giving birth in these locations may have been the highest worldwide (Commission of Investigation into Mother and Baby Homes, 2021). For this reason, quantitative analysis of data on women and their infants from the largest local-authority and religious institutions is relevant for documenting the experiences of this cohort. These institutional records allow us to investigate one dimension of the consequences of social and cultural attitudes and practices towards women who gave birth and were marginalised, and while elevated infant mortality was not the only important characteristic of the Homes, we focus on it in this analysis because our data are best suited to address it.

The main goal of this paper is to provide initial descriptive evidence on the infant mortality rates that prevailed in these Mother and Baby Home institutions, to quantify how this risk of mortality changed over the course of the 20th century relative to the general population in Ireland, and to assess variation in death rates by observed characteristics. Although we do not have the means to assess causal questions with these data, our aim with this analysis is to provide an initial first step towards a better quantitative understanding of conditions in these Homes. Our main research hypothesis is that there was a substantial difference in mortality between the institutions and the general population which decreased over time. We test this hypothesis by computing descriptive statistics and comparing mortality rates in the institutions over time with those in the country as a whole. As a secondary research question, we assess how the mortality rates varied by the characteristics of children in the Homes that we observe. Our secondary research hypothesis is that these demographic factors

will strongly predict risk of mortality, and we will assess this secondary hypothesis through decomposing changes in mortality rates into proximal causes.

The rest of this paper is structured as follows. We begin by describing the conceptual framework we use to approach our research questions. Next, we provide background to religious institutions and Homes in Ireland, and early life mortality in the general population. We then present descriptive statistics on the data, including mortality rates across institutions and over time. In the next section we implement a decomposition analysis to assess which factors contributed to the mortality declines we observe. We conclude with a discussion of our findings.

Conceptual Framework

In this analysis, we consider infant outcomes within the framework modelling structural and social determinants of health proposed by the World Health Organization (Marmot et al., 2008; Wang et al., 2020). It conceptualises perinatal health outcomes as a function of intermediary pathways, which include material circumstances, social and family resources, healthcare utilization access and quality, health behaviors, environmental exposures, and pregnancy health. These intermediary pathways are a function of the person's own sociodemographic characteristics including social class (education, occupation and income), marital status, their race and ethnicity, and their gender. The relationship between these characteristics and maternal and infant outcomes is determined within the wider economic, cultural, and political context, which include societal values and norms that govern social interactions and influence the occurrence of phenomena such as structural racism and discrimination.

In the context of the Mother and Baby Homes, we expect there to be two major pathways through which outcomes are adversely impacted for the population in the institutions. First, we anticipate that social stigma associated with births outside marriage will result in discrimination against the population affected by the Homes, resulting in fewer material resources and social support, reduced access to quality healthcare, and because discrimination has been shown to impact directly on health, their health during the pregnancy. An established literature documents the mechanisms through which these disparities arise, which can be categorised into differential treatment and differential access to resources operating through either interpersonal interactions or institutional/societal policies, practices and norms (Alhusen et al., 2016). Examples of differential treatment include experiences of maltreatment, violence, or interpersonal discrimination leading to direct physical harm or increased psychological distress and raised allostatic load (Hux et al., 2014). Examples of differential access include being excluded from appropriate healthcare or being denied sufficient economic resources. In the US, experiences of discrimination have been consistently found to predict, at least in part, racial disparities and inequities in adverse birth outcomes (Giurgescu et al., 2011).

Second, we anticipate greater exposure to environmental risk factors such as reduced nutritional intake and overcrowding, arising because of the institutional nature of the Homes, insufficient resources, or the way they were run. As well as comprising a potentially vulnerable group, numbers in this category were large in absolute terms in many countries. Therefore, understanding the experience of these

women and children is important for documenting the full demographic history of a country or location.

Background to Mother and Baby Homes in Ireland

According to Earner-Byrne (2008), a major focus of public policy in the early days of Irish independence (the Irish Free State was established in 1922 after independence from the United Kingdom) was on using the traditional view of family life as a means to control the social, economic and political life of the population. Strongly influenced by the role the Catholic church played in all aspects of society, this meant that relationships and behaviors that deviated from this view of a family comprising a married couple with children were seen as threats, not just to the family as an institution, but wider society. One manifestation of this was the widely shared view that sex before marriage should be socially unacceptable, and that births resulting from these unions should not be viewed as constituting a family in the socially understood and supported definition (Earner-Byrne, 2008). Due to the associated stigma and discrimination, many women have been prevented from, or may not have felt welcome, giving birth or receiving postpartum care in the general hospital system. For example, although hospitals in Dublin (the capital city) did provide maternity care for women from a variety of backgrounds, hospitals in other parts of the country may have excluded unmarried women, who were often sent to one of the Mother and Baby Homes instead. Part of the motivation for these exclusionary practices was the belief, mentioned above, that exposure to alternative behaviors, especially related to pre or extra-marital sex, could have a negative influence on prevailing social norms. As a result, separate spaces emerged for pregnant women who were prevented from or were otherwise unable to obtain the support (financial or otherwise) of their family and/or the father of their child, were forced to leave home, or did not wish to disclose the pregnancy to their family, friends and neighbors (Commission of Investigation into Mother and Baby Homes, 2021).

These institutions came into operation through a variety of pathways. Many of the local-authority run Homes emerged from workhouses, which were pre-independence institutions that provided food and lodging for those who could not support themselves in exchange for work. Several of the private religious run Homes were newly established as maternity centers after independence, with part funding provided by the state. Following World War 1 and through the 1920s and 1930s, the number of births occurring outside marriage increased, leading to the establishment of the Homes that would account for the majority of institutional births over the following decades.

In this paper we use summary data on these Homes obtained from the reports of the Irish Mother and Baby Homes Commission of Investigation, which was established in 2015 to investigate these institutions The establishment of the Irish Mother and Baby Homes Commission of Investigation was in part prompted by the discovery of an unmarked grave containing the remains of more than 800 infants at the site of one of the Homes (the Bon Secours Mother and Baby Home at Tuam, a town in the rural west of the country). This led to calls in the media and among the general public to document who these infants were and how they died. The Commission's terms of

reference included a remit to investigate the living conditions experienced by residents, mortality and other outcomes for mothers and infants, the means by which mothers and infants entered and left the institutions, and compliance with medical, ethical and reporting standards.

The commission issued six interim reports, with the final report being published in February 2021 (Commission of Investigation into Mother and Baby Homes, 2021). The period under investigation by the commission ranges from the establishment of the Irish state (1922) until 1998 when the last Home closed.

The Commission prepared an analysis dataset for the six largest institutions in Ireland, which were Bessboro House, Bethany Home, Manor House Castlepollard, Pelletstown (now known as St Patrick's), Sean Ross Abbey, and Bon Secours Mother and Baby Home Tuam. Of the institutions located in an urban setting, Pelletstown and Bethany were located in Dublin (the capital city), while Bessboro House was located in Blackrock, Cork (the second largest city in Ireland). Of the institutions located in a rural location, Manor House Castlepollard was located in County Westmeath, Sean Ross Abbey in Roscrea County Tipperary, and Bon Secours Mother and Baby Home in Tuam County Galway. These were largely self-contained institutions where mothers were expected to stay and participate in work or caring for their infants within the institution itself. Therefore, women went there to take up residence for the duration of their stay rather than commuting from their prior location. For this reason, these institutions were not designed to only provide for the population in the immediate vicinity, with many women transferring in from other locations, including other counties. Geographically, of the six largest institutions which we consider in this paper, 3 were located in or near the major population centers (the cities of Dublin and Cork), with the rest in a rural location. With a sample size of 6, it is difficult to assess whether their location is systematically related to any specific characteristics, except that they reflected existing prior facilities, either those of the religious organizations or the local authorities. The location of the six Homes is shown in Fig. 1.

As well as their geographic location, the Homes differed in their admission eligibility rules. Bessborough, Castlepollard, Sean Ross Abbey and Bethany were solely Mother and Baby Homes (for unmarried mothers). In contrast, Pelletstown also housed orphans, and ill children, while residents of Tuam included homeless families and children. In addition, Pelletstown and Tuam were local authority institutions while the others were private (Commission of Investigation into Mother and Baby Homes, 2019). Further information about the institutions are available in Redmond (2018) and the Commission's interim and final reports which are publicly available (https://www.gov.ie/en/publication/316d8-commission-of-investigation/), and which cover other aspects of their work and terms of reference. As described in the Introduction, in this paper, we focus on the mortality outcomes of infants.

National Mortality Context

Initially, during the first two decade of the 20th century, rates of infant mortality in Ireland as a whole were below those in the neighbouring countries of England, Scotland and Wales, but from the 1930s through the 1960s Ireland performed poorly with death rates up to 50% higher in some years for infants before the age of one

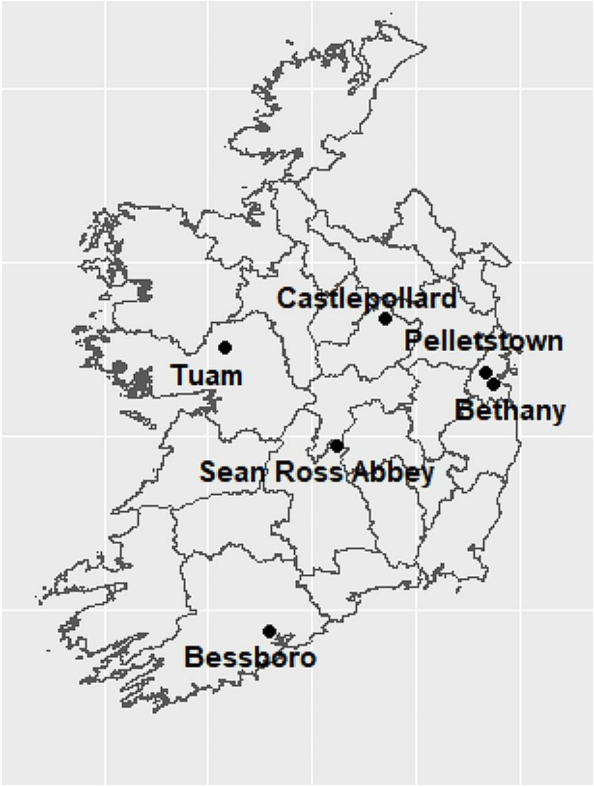

Fig. 1 Map of Ireland showing the location of the six largest mother and baby homes. Note: County borders are shown, with Northern Ireland excluded

(McGovern, 2016; Ó Gráda, 2019; Walsh, 2017). Excess mortality was particularly apparent during the mid to late 1940s. During this time, Ireland ranked 16th out of 20 high income countries (United Nations, 2015). Worldwide, including in Ireland albeit at a lower pace, the period after World War 2 was one of rapid progress in reducing early life mortality. Even in Ireland, the national rate fell from an average of 7.5% (75 deaths per 1,000 live births) before age 1 in the late 1930s to 3% in the early 1960s. A number of papers have examined this decline, and hypothesised mechanisms include improvements in water and sanitation (Alsan & Goldin, 2019; Cutler & Miller, 2005), devolution of responsibility for public health to local authorities (Bhalotra et al., 2017; Hoehn-Velasco, 2018), public health regulations (Komisarow, 2017), rural development (Lewis, 2018), and advancement in medical technology such as the availability of vaccines. These factors are hypothesised to play a role in the decline in mortality in Ireland, although a lack of data makes systematic testing of these hypotheses difficult. They have however been demonstrated to be important in a variety of contexts (Bhatia et al., 2019).

In Ireland, there were important differences in mortality by location. There was a substantial urban mortality penalty compared to rural areas during the early part of the 20th Century. In Dublin, infant mortality averaged 10% during the 1940s, compared to a rate of 5% in rural counties such as Mayo (Delaney et al., 2011). In large part, the decline in mortality up to and including the 1960s was the result of

a closing of the urban-rural penalty, a phenomenon also observed in other countries (Haines, 2001). Socioeconomic status has been documented as an important predictor of mortality in Ireland (Deeny, 1995; McGovern, 2016; Ó Gráda, 2004) and the US (Stockwell et al., 1994).

The early 1940s is an important period for a number of reasons. First, in terms of international events, World War 2 had a devastating impact on global affairs, not least through the death toll exacted on countries directly involved. Although Ireland was neutral and did not formally engage in the military conflict (within Ireland the period was referred to as "The Emergency"), the country was nevertheless affected in a number of ways. And while Ireland (the southern part of the island which gained independence in 1922) was neutral, Northern Ireland (the northern part of the Island which became a separate entity after 1922) remained part of the United Kingdom and was thus directly affected. For example, Belfast, the main city in Northern Ireland, was bombed repeatedly with over 1,000 civilian deaths. Dublin, the main city in Ireland, did suffer a number of incidents in 1940 and 1941, but with far fewer casualties. In addition, Ireland was affected by the restrictions on food supply that were widespread during this period, which resulted in rationing and reductions in caloric intake and nutritional quality. These restrictions likely contributed to the increase in gastroenteritis-related mortality during World War 2 (Deeny, 1995). There is some evidence that reductions in breastfeeding were at least partly responsible for the increase in gastroenteritis as a cause of death among infants during this period (Deeny & Murdock, 1944).

Second, although there is year-to-year variation, overall death rates declined rapidly following 1947, resulting from a series of improvements in underlying risk factors and policies that resulted in the elimination of the urban penalty in Ireland. Previous research has linked the 1947 Health Act and investments in sanitation, nutrition and clean water to these declines (Delaney et al., 2011), which is consistent with evidence from other countries (Alsan & Goldin, 2019; Cutler & Miller, 2005; Hoehn-Velasco, 2018; Komisarow, 2017).

During much of the 20th century the strong social stigma associated with extramarital births in Ireland occurred alongside a substantial additional risk of mortality for infants born to unmarried mothers, many of whom either gave birth in a Mother and Baby Home or were subsequently transferred there after giving birth in a local hospital (Daly, 1986, 2010; Earner-Byrne, 2007, 2008). Another group of unmarried women travelled to the UK to give birth, mirroring the wider phenomenon of migration in the general Irish population (Delaney et al., 2013). Throughout the 1940s there were around 500 births to unmarried mothers per year, compared to 2000–3000 in Ireland as a whole. During this period, the infant mortality rate among unmarried mothers was around 30% compared to an overall national rate of 7.5%. This is the context in which the institutional data fit.

Data and Methods

Under their terms of reference, the Commission were to investigate 14 religious-run Mother and Baby Homes, along with 4 state-run institutions selected to be a representative sample of the state institutions for comparison. The Commission obtained

the paper records of admission, residence and discharge of the larger Mother and Baby Homes from the Irish Child and Family Agency, and proceeded to digitise these records, with additional data obtained from vital statistic mortality records and local authorities (Commission of Investigation into Mother and Baby Homes, 2017). In preparing their main analysis dataset that we use to investigate mortality, the Commission made the decision to include only the six largest institutions because they accounted for almost all of the births in the Mother and Baby Homes. As a result, we were unable to consider any of the remaining institutions, however given their size we expect their omission to have little impact on overall mortality patterns. Information available mainly comprised birth records. The data included, for each infant, the institution, place of birth and death, date of birth and death, date of admission and discharge, private or public patient, mother's date of admission and discharge, mother's date of death, whether the birth was a live birth, and whether the birth was a multiple birth or not. Cause of death information was obtained from vital statistics (from the Registrar General) mortality records. Other aggregate data on the characteristics of these institutions has been documented by the Commission, for example the source of mother referrals or mother's occupation, which provides some insight into the population served by the institutions.

The accuracy of the data on entry and exit from the institution relies on how well the institutions recorded this information, however the data on mortality formed part of the wider national vital statistics reporting system. While the vital statistics system in Ireland at the time was not immune to error (Coward, 1982; Walsh, 2017), the extent of under-registration of births would need to be of an implausible order of magnitude to explain the substantial temporal and regional differences observed in the national infant mortality data. Regarding the Homes specifically, in their conclusions about the registration of deaths, the Commission states: "the evidence compiled by the Commission suggests that the institutions being investigated did generally comply with the requirements for the registration of deaths. Most deaths in the institutions are recorded as certified." (Commission of Investigation into Mother and Baby Homes, 2021; Chapter 33, p.8). Under-registration of deaths in the Homes would understate the already substantial differentials we document below, but given we were unable to locate any other comparable dataset in the literature, it is difficult to assess whether these records are affected by misclassification bias as there are few opportunities for external validation. This is an important limitation and direction for future research. Data on the number of deaths by age, institution and decade, as well as cause of death were published in the reports (Commission of Investigation into Mother and Baby Homes, 2021). In total, the records from the six institutions contain data on 48,673 infants. Of these, 4,963 had no information on their year of birth. Of the remaining 43,673, 712 (1.6%) were stillbirths and 4 were miscarriages. The only criteria for inclusion in this analysis was that the birth be a live birth; miscarriages and stillbirths were excluded as the goal was to examine mortality in the institutions which precluded consideration of the former. This leaves an analysis sample of 42,982.

Supplementary Table 1 gives the number of births in the analysis sample in the six institutions under study by decade. In total there were 42,982 births in the six institutions, with Pelletstown being by far the largest (with almost 17,000). The decade with the largest number of births varied by institution, but overall the 1960s had the

most (with 21% of the total number of births). Bethany, Sean Ross Abbey, Tuam, and Castlepollard had relatively few births after this period. Sean Ross Abbey closed in 1969 while Bethany and Castlepollard closed in 1971. Bessoboro and Pelletstown continued to admit in the 1970s and 1980s. There were very few births recorded for these institutions in the first two decades of the 20th century, but a substantial number of births were recorded for Bethany, Pelletstown, and Tuam in the 1920s, with all institutions appearing fully operational by the 1930s.

In order to address our research questions, we first document death rates for infants admitted to the Homes by computing descriptive statistics on mortality by age, institution, and cause of death. To quantify how this risk of mortality changed over the course of the 20th century relative to the national rate, we compare aggregate mortality rates by year in the six Homes with mortality in the general population. Second, to assess which factors contributed to differences in mortality rates between the Homes and the general population, we decompose changes in mortality in the two populations into changes attributable to the mortality types that we observe consistently in each group (age, time of birth, and cause). We focus on the 1940s because it was the period during which we observe the greatest decline in mortality, both in the Homes and the general population. Further details of this approach are provided in the supplementary material. All data analysis took place in Stata 16, except for the map (Fig. 1), for which we used R version 4.02.

Results

Descriptive Statistics for the Institutions: Infant Characteristics

Table 1 presents descriptive statistics for infants in the dataset. Most infants were born to mothers who were aged 21–30 (41%), were born in the institution itself (57%), and were accompanied upon admission (82%). The modal length of stay category was 14–30 days (21%) with the mean being 295 days, and overall, 16% of infants admitted to the institutions died.

Descriptive Statistics for the Institutions: Mortality data

In this section, we first compute overall descriptive statistics for mortality in the institutions, and then disaggregate by age at death and cause at death. Table 1 shows that overall 16% of the infants who entered the institutions ultimately died. 8% of infants died in the first week of life (0–7 days), with a further 10% in the neonatal period (8–28 days). In terms of cause of death, 18% were classified as "Non-specific" as they did not have adequately specific information to ascertain a primary cause (because they were originally listed as, for example, congenital debility). Of the remaining causes the most common were respiratory infections (18%), followed by gastroenteritis (14%), and malabsorption (9%). While Table 1 shows summary data for all Homes, additional analyses indicated that institutions show a similar pattern in terms of age and cause of death.

Table 1 Descriptive statistics for Mother and Baby Home infants

	Total (*N*)	% Died	% Did not Die		Total (*N*)	% Died	% Did not Die
Institution				**Mother's Age Group**			
Bessboro	9219	10%	90%	< 16	582	11%	89%
Bethany	1408	18%	82%	16–20	14,643	13%	87%
Castlepollard	4518	5%	95%	21–30	18,035	15%	85%
Pelletstown	19,190	18%	82%	31–40	3297	15%	85%
Sean Ross Abbey	6191	17%	83%	40+	347	14%	86%
Tuam	3172	30%	70%	Missing	6794	26%	74%
Total	43,698	16%	84%	Total	43,698	16%	84%
Decade of Birth				**Infant's Age at Admission (Days)**			
1900-1919	316	35%	65%	0-1	24,857	15%	85%
1920s	3744	42%	58%	1-13	7577	13%	87%
1930s	6832	33%	67%	14-29	2266	28%	72%
1940s	7771	26%	74%	30-59	1526	31%	69%
1950s	6021	8%	92%	60-98	1187	29%	71%
1960s	8369	4%	96%	99-119	3163	7%	93%
1970s	6367	2%	98%	120-364	1682	25%	75%
1980s	4278	1%	99%	365+	1440	15%	85%
Total	43,698	16%	84%	Total	43,698	16%	84%
Month of Birth				**Infant was Born in Institution**			
1	3541	17%	83%	No	18,274	18%	83%
2	3271	15%	85%	Yes	24,708	15%	87%
3	3947	16%	84%	Total	42,982	16%	86%
4	3926	15%	85%				
5	4172	16%	84%	**Mother Admitted to Institution**			
6	3906	16%	84%	No	7719	23%	77%
7	3852	16%	84%	Yes	35,979	14%	86%
8	3676	16%	84%	Total	43,698	16%	84%
9	3567	16%	84%				
10	3262	16%	84%	**Infant was a twin**			
11	3201	16%	84%	Yes	43,256	16%	84%
12	3377	17%	83%	No	442	27%	73%
Total	43,698	16%	84%	Total	43,698	16%	84%
				Infant's Length of Stay in Institution (Days)			
				0-1	315	63%	37%
Infant Died				1-13	4773	19%	81%
No	36,756			14-29	5977	15%	85%
Yes	6942			30-59	7373	17%	83%
Total	43,698			60-119	7046	22%	78%
				120-364	6133	22%	78%
				365+	4308	14%	86%
				Total	35,925	19%	81%

Table 1 (continued)

	No.	%		No.	%
Timing of Mortality			**Cause of Death Category**		
Perinatal Period	553	8	Congenital Heart Disease	238	4
Neonatal Period	696	10	Convulsions	305	4
Infant Period	4,683	67	Diphtheria	107	2
Child Period	970	14	Gastroenteritis	934	14
Other	50	1	Generalised infections	219	3
Total	6,952	100	Haemorrhage	155	2
			Influenza	147	2
			Malabsorption	638	9
			Measles	108	2
			Meningitis, Encephalitis	244	4
			Non-specific	1,226	18
			Other	452	7
			Respiratory Infections	1,215	18
			Spina Bifida	205	3
			Syphilis	166	2
			Tuberculosis	432	6
			Total	6,791	100

Note Infants without a date of birth or death are excluded. The infant mortality rate is defined as the number of deaths before age one per 1,000 live births. The start year for the infant mortality series for each institution is set to the year in which 30 births or more are recorded in that institution. Source - institutional records

In Fig. 2, we show rates of infant mortality by year for each of the institutions, defined as the number of deaths per 1,000 live births within the first year. Any infant who was a live birth and died before their first birthday is included in the numerator. The denominator is all live births for that location (institution) in a given year. Throughout the 1940s, all the institutions apart from Castlepollard exhibited an infant mortality rate of up to 40%. Most institutions exhibit elevated rates during the 1940s followed by a substantial decline.

While infant mortality is widely used as an overall health indicator, deaths do not typically occur uniformly over the first year of life, and examining age at death in more detail can help identify periods during which mortality is most likely to occur. For example, a relatively high proportion of deaths during the first few days of life might indicate elevated risk due to birthing conditions or procedures.

Figure 3 gives the infancy period mortality rate, which is the number of deaths per 1,000 live births within the period 29–365 days. Supplementary Fig. 8 shows the perinatal mortality rate, the number of deaths per 1,000 live births within the first 7 days. For this and the other rates, deaths at other ages are excluded from the calculation. For example, if an infant was a live birth and died at 6 months they are in the denominator for the perinatal mortality rate but not the numerator. Supplementary Fig. 9 gives the neonatal mortality rate, which is the number of deaths per 1,000 live births within the period 8–28 days. If an infant was a live birth but died before 8 days they are present in the denominator but not the numerator. Note that this is different to the infant mortality rate presented elsewhere in this paper as the infant mortality rate includes all deaths within the first year, whereas for the infancy period mortality

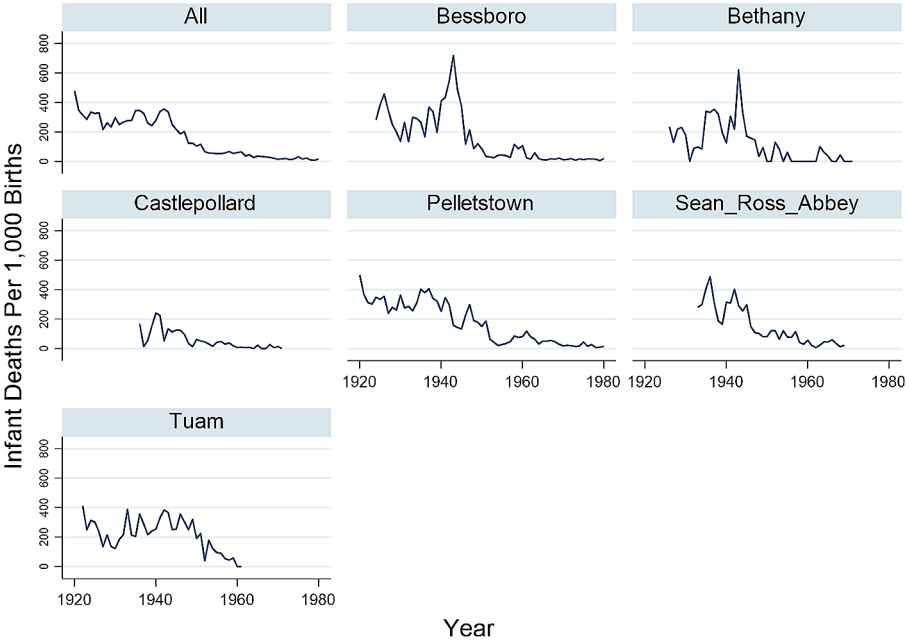

Fig. 2 Infant mortality rate by institution. *Note*: Infants without a date of birth or death are excluded. The infant mortality rate is defined as the number of deaths before age one per 1,000 live births. The start year for the infant mortality series for each institution is set to the year in which 30 births or more are recorded in that institution. Source - institutional records

rate deaths before 29 days are excluded. Supplementary Fig. 10 shows data for deaths during the childhood period.

Overall, the mortality rates by age all show a substantial decline (as a percentage of their initial rate). Across all institutions, the perinatal rate fell from a peak of 20 deaths per 1,000 live births in the 1940s to less than 5 in the 1980s. The corresponding 1940s peak for the neonatal, and infancy period were 30, and 280, respectively. Therefore, the infancy period from 1 month to a year accounts for the vast majority of all deaths in the institutions.

Comparison between Infant Mortality in the Institutions and the General Population

In order to assess the magnitude of the difference in birth outcomes between infants in the general population and those recorded in the data from the Mother and Baby Homes, we begin with a comparison between institutional (the average among all children in the records for the six institutions) and national infant mortality rates in Fig. 4. It is apparent from this figure that death rates in the 1940s were 3–4 times higher in the institutions than the country as a whole. An infant mortality rate of 30% represents a death rate which is rare in a general population outside of war or famine conditions. By the mid to late 1960s however, the institutional mortality rate had converged to the national average. Although the institutional rate fell by a much

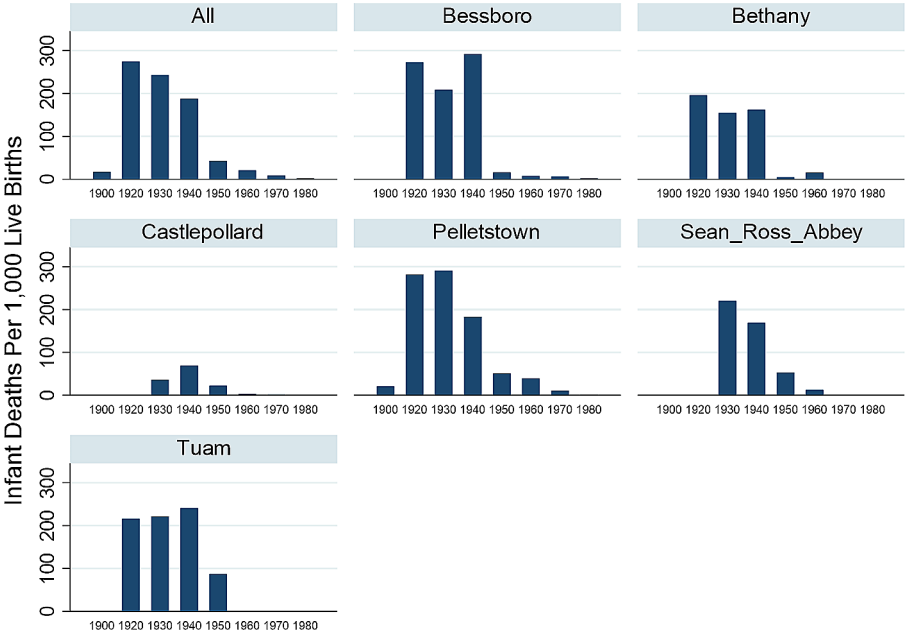

Fig. 3 Mortality rate during the infancy period by institution and decade. Note: Infants without a date of birth or death are excluded. The mortality rate during the infancy period is defined as the number of deaths between 29 and 365 days old per 1,000 live births. Deaths at other ages are not included. Source - institutional records and authors' calculations

larger 400% over the period from the 1920s to the 1960s, the national rate also fell by a substantial 200%. Overall, mortality rates in the Homes mainly resembled mortality rates among all infants of unmarried mothers, which in part reflects that the former were a high percentage of the latter. For example, in the 1940s infant mortality in the Homes was 23% compared to 22% among all unmarried mothers.

Figure 5 and Supplementary Figs. 2–7 present a comparison of mortality in each home with that in the surrounding counties. We use the ratio scale to illustrate the relative magnitude of the differences and how the national and institutional series change over time. Pelletstown, Sean Ross Abbey, Tuam, and Bessboro all exhibit much higher rates than their surrounding counties. However, differences are less apparent for Bethany and Castlepollard. This comparison has the drawback that the mortality series is affected by small numbers when stratifying by institution. In addition, even within counties mortality was heterogeneous and thus does not necessarily represent a good comparison population with which to contrast infants in the institutions (Deeny, 1995; Ó Gráda, 2004). All institutions show some evidence of convergence with the national rate by the late 1950s. With only six Mother and Baby Homes it is difficult to establish any pattern according to the characteristics of the counties or location of the Homes (e.g. whether they were in an urban or rural location). Moreover, most Homes admitted women from a relatively wide geographical area, with two exceptions being Tuam which admitted from the counties of Mayo and Galway, and Pelletstown, which during the 1940s, admitted from Dublin.

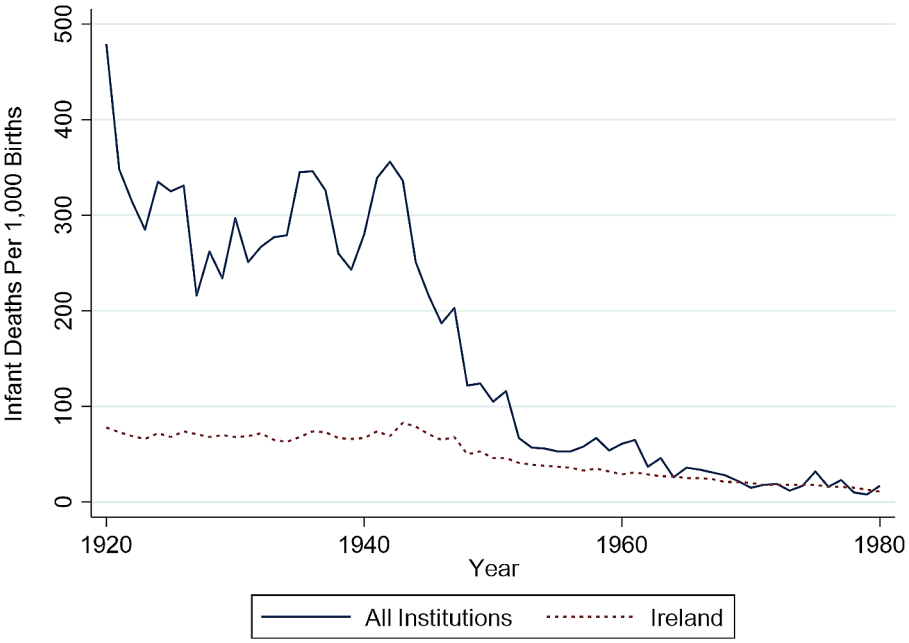

Fig. 4 Infant mortality rate in ireland and all institutions. Note: Infants without a date of birth or death are excluded. The infant mortality rate is defined as the number of deaths before age one per 1,000 live births. All institutions refers to the 6 Mother and Baby Homes considered in the paper. Source - institutional records and Registrar General Reports

While there are level differences between infant mortality in the Homes and the surrounding counties, the overall trend is similar, with a period of convergence after World War 2 which corresponds with the main period of decline in the national rate. Nevertheless, the mortality rate in some institutions remained elevated even after this period. Figure 6 shows the mortality rate in the Homes in comparison with other higher income countries during the period 1950–1955. The 3 worst performing Homes (Pelletstown, Sean Ross Abbey, and Tuam) all had death rates substantially above other countries.

Decomposing Causes of Mortality Declines

In the institutions, infant mortality fell from an average of 31.3% in 1940–1944, to 17.1% in 1945–1949. When we decompose these changes by time of death and cause of death, we find that declines in mortality followed similar patterns in the Homes and the general population. For example, mortality declines during the infancy period (age 29–365 days) accounted for 76% of the overall decline in infant mortality in the institutions, and 74% of the decline in infant mortality in the country as a whole. For the institutions, declines in nutrition-related and influenza-related causes accounted for 28% and 20%, respectively, of the overall decline in infant mortality during the 1940s. Similarly, for the national rate, declines in nutrition and influenza and related

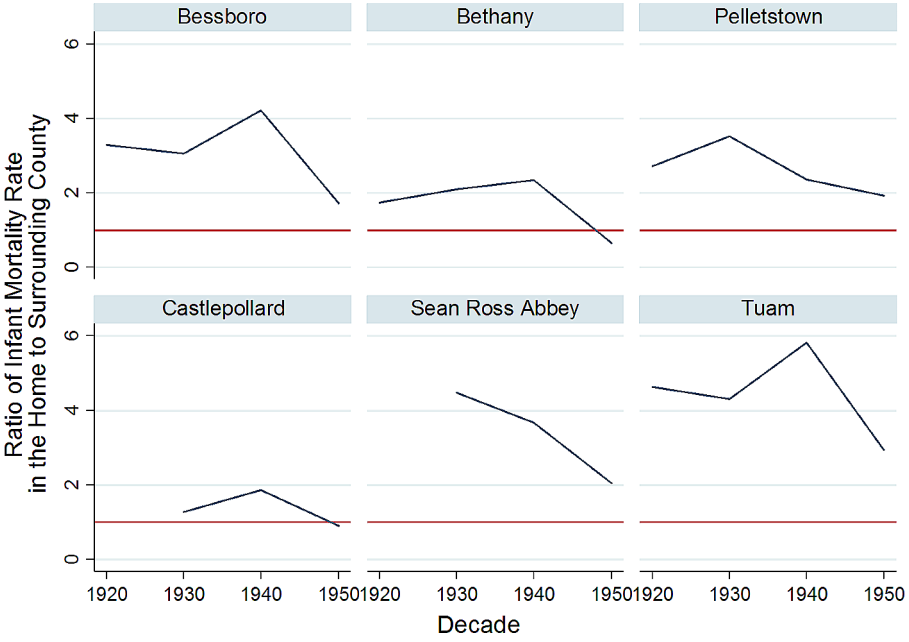

Fig. 5 Ratio of Infant Mortality in the Institutions and the Surrounding Counties by Decade. *Note*: The ratio on the Y axis is defined as the infant mortality rate in the institution divided by the infant mortality in the county in which the institution is located, for each decade. The red line indicates a ratio of 1, i.e. the institutional mortality rate is the same in the institution and surrounding county. Infants without a date of birth or death are excluded. The infant mortality rate is defined as the number of deaths before age one per 1,000 live births. Source - institutional records and Registrar General Reports

causes accounted for 34% and 16% of the overall decline in infant mortality during this period. We present a full set of decomposition results in the appendix.

Discussion and Conclusion

Overall, we find that, particularly in the early half of the 20th century, babies in the Mother and Baby Homes in Ireland were at a substantially higher risk of mortality than the general population. The mortality penalty for these institutions was greatly elevated, reaching four times the national mortality rate in the 1930s and 1940s. Mortality rates in the institutions were also substantially higher than the surrounding counties in which they were located, although there was a degree of variation in the extent of the excess mortality by institution. In some years, 30% of babies died before reaching their first birthday. We document a turning point in the institutional mortality rates during the 1940s, after which rates converged to those in the general population and the mortality penalty was substantially reduced by the 1960s. Of the six institutions considered in this analysis, only one (Castlepollard) avoided peak infant mortality of 300–400 deaths per thousand live births, suggesting that, at least among the larger institutions considered in this paper, there was a shared pattern of mortality and excess deaths. Overall, Tuam had the highest mortality rates, which may reflect

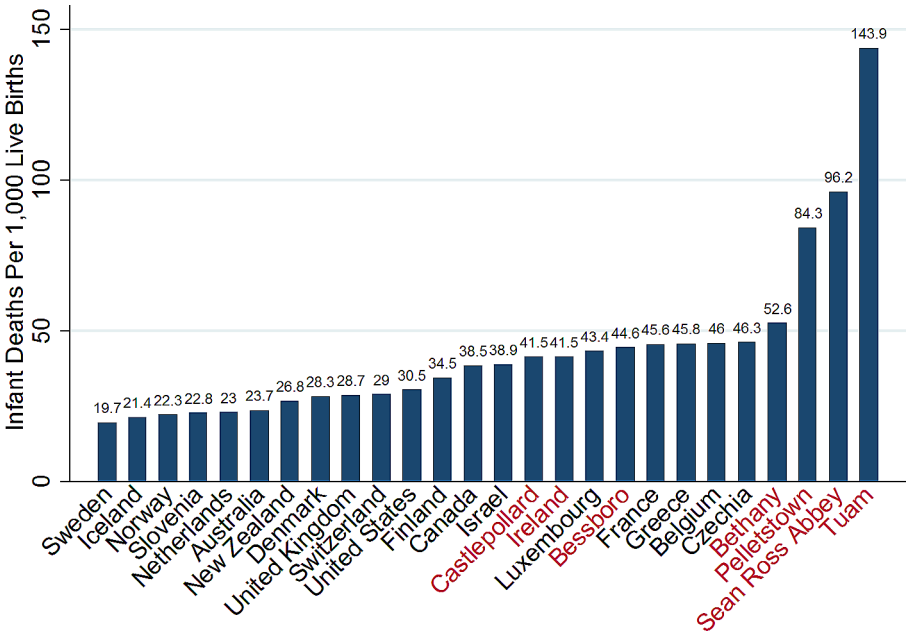

Fig. 6 Infant mortality 1950–1955 for the 20 best performing countries, and Mother and Baby Homes. Note to Figure 6: Ireland and the institutions are shown in red. Source - UN World Population Prospects (2015), institutional records and authors' calculations

that this institution admitted not only unmarried mothers, but also families who were experiencing homelessness. Unfortunately, we currently lack the data to examine mortality rates in these different groups separately to investigate this further. In terms of hypotheses for why infant mortality was relatively lower in Castlepollard, we can reasonably rule out differences in the local environment. As shown in Fig. 5, infant mortality in Westmeath (where Castlepollard was located) did not differ from other counties where the remaining institutions were based. One hypothesis is that overcrowding was a risk factor for mortality. However, the Commission investigating the Homes reported that overcrowding in Castlepollard was severe, with there being no space in this institution during the 1940s for storage of personal effects and no room for children to play (Commission of Investigation into Mother and Baby Homes, 2021). Therefore, we can rule this out as a factor in Castlepollard's relatively lower mortality rate. Instead, a potential explanation is the construction of a modern (for its time) hospital at the Castlepollard site in 1942, which was able to accommodate and provide care for some of the mothers in this Home. Augmenting our current analysis with use of healthcare services would require additional data and linkages, but would provide more definitive evidence on which policy interventions supported the affected population.

Our decomposition analysis comparison between institutional and national mortality declines in the 1940s, which was the decade showing the most rapid improvement, suggests that the underlying pattern was similar in both populations. During this decade, mortality fell by around 50% in Ireland as a whole, and also by 50% in

the institutions (albeit from a much higher base). In both populations, most improvements came during the infancy period (28 days to a year) and were due to reductions in nutrition-related causes. As shown in Supplementary Fig. 12, infant deaths in Ireland peaked during the years of World War 2 and declined rapidly thereafter. The fact that nutrition-related causes accounted for a similar share of deaths inside and outside the Homes suggests the underlying risk factors may have been similar, but with greater exposure, and potentially greater effect, of these risk factors for those in the institutions.

In terms of future research, establishing why rates of mortality were so high in the institutions remains a priority. There are two hypotheses about why the mortality rates in the institutions might differ from that in the general population, reflecting the experiences of the women and infants before and after they entered the Homes. Under the first hypothesis, the population entering the Homes had systematically different life experiences from those in the general population at, and these experiences were related to mortality risk. As well as events during pregnancy, pre-pregnancy characteristics are also know to predict birth outcomes, and possible experiences that impacted on these women include the discrimintation and stigma described in the Introduction, resulting in differential access to material resources, social networks, or prior health conditions. Under the second hypothesis, the differential environment in the Homes raised the risk of mortality. This could be due to differences in the quality of care, socialisation, sanitation, and maltreatment or discrimination against women who were admitted, and their infants. It seems likely that a combination of these two hypotheses may have been responsible, i.e. mortality differences may have been at least partly due to both prior life experiences and what occurred in the Homes.

As we do not have data on the prior life experiences of women before they entered the institutions, we are limited in our ability to quantitatively distinguish between the two hypotheses about elevated rates of mortality in the Homes. What we document in terms of the cause of death and age at death data, is that the same causes (notably nutrition) and age (infancy) account for the same proportion of deaths in the general population and the Homes. In both, most deaths occur in infancy, and in both the most common specific causes are nutrition and influenza-related. In the first half of the century when the gap is largest, overall mortality rates are much higher in the Homes even if the constituent contributors remain in the same relative proportions. This could be consistent with an overall shift in the baseline risk of mortality for those entering the Homes. However, it could also be explained by the environment in the Homes amplifying risk factors shared in common between those in the Homes and the general population. For example, experiencing undernutrition or contracting influenza may have been much worse in the Homes because of some aspect of the shared environment, such as living in close proximity, lower quality of care for those in need of medical treatment, or discrimination.

In terms of age at death, we find that the majority of mortality declines in the Homes takes place in the period between 1 month and one year of age. In general, mortality in the period prior to a month of age is largely determined by conditions and diseases that are associated with lack of quality care at or immediately after birth and in the first days of life (Hug et al., 2019). Therefore, this suggests it may not have been changes in early life medical care, for instance the introduction of

clinical interventions for low birth weight or premature infants, that made the most significant impact on mortality patterns in the Homes. Instead, mortality in the period after a month of age is more typically associated with social and environmental factors. In other words, while the mortality patterns by age do not directly support the healthcare hypothesis, this does not rule out some other aspect of the environment in the Homes being important. For instance, mortality due to nutrition related causes were common, likely reflecting inadequate food or sanitary resources in the Homes. In addition to the question of why mortality rates were higher in the institutions, a related and similarly important issue is why the disparity with the rest of the population narrowed after the 1940s. As with the discussion above, it is possible to approach this from the perspective of two hypotheses. First, the life experiences of those in the institutions may have changed (for example, selection due to marginalization or discrimination may have lessened over time), or second, the environment in the Homes may have improved (for example, improved living conditions or better health care). Unfortunately, we lack data on how characteristics of those entering the Homes has changed over time, but we were able to examine how causes of death and age at death changed in both populations. Observing a differential change in a cause of death in the institutions (for example, a large decline in pneumonia-related mortality that did not occur in the general population) would help identify relevant mechanisms. However, for the two factors we are able to investigate and compare with the general population, the same patterns are exhibited. As with cause of death, the age-related mortality pattern was the same in both groups, with the largest decline in the general population also taking place in the infancy period (accounting for 74% and 76%, respectively, of the total decline in infant mortality during the 1940s). Therefore, we hypothesise that general trends in sociological and cultural factors that differentially affected women in the Homes (for example a lessening of the stigma associated with births outside of marriage), or affected who was admitted into the Homes, may have played a role. Alternatively, the availability of medical, economic, or other relevant policy interventions may have lessened the disadvantage experienced by those in the institutions. While the common pattern in age and cause of death shared inside and outside the institutions suggests that similar mortality processes affected both groups, the overall higher death rate in the Homes may imply that these infants were relatively more affected by a common set of risk factors. For instance, while nutrition may have mattered for all infants, those in the Homes may have been at greater risk of contracting gastroenteritis, for example because of overcrowding. Unfortunately, we lack the data to test these hypotheses, and this is an important direction for future research. It is important to emphasise that none of these hypotheses preclude a critical role for stigma, discrimination, and other forms of maltreatment of the affected women.

This paper has a number of limitations. First, we are relying on records kept by the institutions themselves to document changing patterns in mortality, and these records may be affected by missing data or misclassification. Second, we are restricted to considering the variables available in these data, and do not have comprehensive information on the prior history of those in the institutions or the day to day running of the institutions themselves. If we had access to individual-level records on a comparison group of women and their infants from the general population (for example,

unmarried mothers who were not admitted to an institution), we could include these individuals in the analysis and use this to assess the extent to which the environment in the Homes was associated with excess mortality. For example, a potentially important factor in explaining changes in mortality patters over time is fertility. In the general population, average family size declined over the course of the 20th century, and previous research has linked fertility change to infant mortality. Potentially more importantly for those in the Homes, mortality risk may have varied by birth order or family size. If, on average, infants in the home changed their relative birth orders or family size compared to the general population (for example because there were an increasing proportion of mothers giving birth to their second or later children in the Homes), this could potentially play a role in explaining why mortality rates converged. This is another reason to expand the data available on the Homes as part of future research. Further archival work that expands the data available for quantitative analysis would be highly valuable in this regard, for instance to explore outcomes among siblings (Dorsten, 1994) or other indicators of infant health (Ma & Finch, 2010). Third, as the goal of this paper was to quantitatively assess levels of mortality and their predictors, we are not able to directly address other important dimensions of the history of the Homes that have been debated since the publication of the final report of the Irish Mother and Baby Homes Commission of Investigation, including coercion, physical abuse, forced adoption, and how to center the testimony of survivors (Condon, 2022). Alternative methodologies should also be pursued to give voice to those affected, such as documenting the oral histories (Tuam Mother and Baby Home Oral History | NUI Galway Digital Collections, 2019). Fourth, in this paper, we attribute a death to an institution only if the infant was a resident. It is possible that those who were discharged experienced a death at a later time point, and we acknowledge that differences in the length of stay could affect our interpretation of how mortality rates change over time. While there was variation across years and institutions, mean and median length of stay were reasonably consistent until the 1960s (115 days in the 1930s, 122 in the 1940s, and 130 in the 1950s). During the 1960s, the median length of stay fell to 69 days, likely reflecting changing social circumstances and additional options available to unmarried mothers. Given the period from 1930 to 1960 was the most important for infant mortality changes, we do not expect much impact on our main conclusions. Finally, our analysis is descriptive, and while it allows us examine trends in mortality, additional studies are required to establish causal factors underlying the patterns we document in this paper. Linking the data used in this paper to changes in the way Mother and Baby Homes were run, along with local-level policy interventions implemented throughout the 20th century in Ireland, is an important direction for future research.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s11113-024-09901-7.

Declarations

Competing Interests We have no funding sources or conflicts of interest to disclose for this paper.

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